

ART. I.—*Studies on the Australian Clavariaceae.*

Part I.

By STELLA G. M. FAWCETT.

[Read 16th December, 1937; issued separately, 23rd January, 1939.]

The plants comprising the family Clavariaceae are commonly known as coral-fungi, taking their name from the larger and more spectacular members, but there are many smaller plants included in the family, which bear no resemblance to coral, and which are more accurately described by the name *Clavaria* (L. clava, a club).

The family Clavariaceae at present includes the following genera: *Clavaria*, *Typhula*, *Pistillaria*, *Lachnocladium*, *Pterula* and *Physalacria*. (*Myromycidium*, long held to be of this family, has been the subject of a paper by Linder (16) who places the genus in the Vuilleminiaceae. The issue is complicated, and will be discussed later, but it is necessary to say that at least two of the premises on which he based his assumption, have, by recent work on *Clavarias*, been shown to be false).

The family Clavariaceae has been fully described by Coker (7) who states that the hymenium is "more or less amphigenous."

In appearance and texture the family approaches the Thelephoraceae from which, in the past, its members were distinguished on grounds of texture and "a more or less amphigenous hymenium." Thus *Sparassis* was formerly included in the Clavariaceae. Engler and Prantl (10) give the position of the hymenium in the Clavariaceae as amphigenous. Although, in describing the family, Rea (19), says that the hymenium is "more or less amphigenous," there is nothing in the generic and specific descriptions of members of the family, to indicate that the hymenium is ever anything less than amphigenous. For instance, Rea states, p. 705, *Clavaria* "hymenium even, amphigenous," p. 720 *Typhula* "hymenium smooth, confined to the clavate portion of the receptacle," p. 722 *Pistillaria* "hymenium smooth, confined to the clavate portion of the receptacle," *Pterula* "hymenium smooth."

I have examined one species of *Pterula*, and the branches, although fine, were cylindrical, and the hymenium amphigenous. Rea (19) does not deal with *Lachnocladium*, but Coker (7), in defining the genus says, "hymenium covering the plant completely, except for the tomentose tips and sterile base."

Coker, in discussing *Physalacria*, states that the hymenium only occurs on the lower surface of the head. In Victorian plants, identified as *P. inflata*, the hymenium was found to cover completely the entire swollen part of the plant.

Thus there is strong evidence for the non-occurrence of dorsiventrality in the Clavariaceae, and I suggest that the amphigenous hymenium is characteristic of the family and serves to distinguish it from the Thelephoraceae.

At the present time the classification of the family is in a chaotic state, as the genera have been poorly defined and several of the definitive characters are of poor systematic value. For instance, differences in texture have been used to separate genera. The texture of a plant is difficult to define exactly, and although a number of plants in the family have indisputably tough, fleshy or waxy textures, difficulties arise when plants showing a texture intermediate between any two of these three are considered, and one finds all gradations between soft, fleshy, gelatinous and woody in this family.

In this account of the Clavariaceae, use has been made, as far as possible, of morphological features in the separation of genera and species.

Distribution and Habit of the Family.

The Clavariaceae is well distributed in temperate and tropical countries, and a few species occur in sub-arctic regions. While each area has a number of species which are peculiar to it, there are many such as *Clavaria botrytis* and *C. flava*, which are of world-wide occurrence. In temperate regions the fruiting periods are generally late autumn and early spring.

Although most members of the family appear to be unspecialized saprophytes, a large number grow only on decaying wood, and others require the decaying parts of specific plants for their growth. For instance *Pistillaria fulgida* Fr. (19) grows only on the dead stems of *Dipsacus pilosus* and *Helianthus tuberosus*, and a large group, including *C. gracilis* and *C. abietina*, will grow only on fallen leaves and twigs of Conifers.

There are a few parasites included in the family, chiefly species of *Typhula* e.g. *T. Itoana* Imai is a parasite on wheat and oats in Japan.

In spite of the apparently unspecialized food requirements of most of the family, attempts to grow them in culture have been unsuccessful, with one exception, *C. complanata* Clel., which grows well on 2 per cent. malt agar. It was thought that cultural characters might be of use in the classification of difficult species.

Tissue cultures were attempted with nine species of *Clavaria* on the following media: malt agar, honey agar, raisin agar; spores of the same nine species were sown on plates of the following media: malt agar, plain agar, sterile soil, honey agar, raisin agar, potato dextrose agar, sterile water, malt agar with lactic acid, and malt agar with sodium hydroxide. Freshly obtained and three months' old spores were used.

Varying temperatures had no effect. Cultures were incubated at 4°C., 23°C., and 30°C., and also at room temperature. In addition a suspension of spores *C. flava* in sterile water, was divided into six parts. Two parts were kept at room temperature, two parts were left in the open and the others were kept at 4°C. This preliminary treatment lasted for five weeks. Then one tube from each set of conditions was heated to 42°C. for ten minutes the others being kept as a control. After this treatment the six tubes were incubated at 30°C. Result: no germination in twenty-one days.

Keeping the cultures in complete darkness had no effect. Digestion experiments were also tried. Three malt agar plates were sown with spores of *C. corallino-rosacca*, and three more with spores of *C. fusiformis*. To the first plate of each kind 0.001 per cent. NaOH and trypsin was added, to the second 0.001 per cent. HCl. and pepsin, and the third plates were kept as controls. All were incubated at 35°C. for 21 days. No spores germinated.

Historical Survey.

Hitherto, accounts of the Australian Clavariaceae have been almost exclusively confined to the genus *Clavaria*. This is understandable as species of *Clavaria* are the most commonly seen. *C. Kalchbrenneri* was described by von Mueller (15) (not *C. Kalchbrenneri* Sacc.), and he sent many specimens to Cooke (8), who published these records together with descriptions of all the Australian species described before 1892. Since then McAlpine has described one species, *C. phyllophila* (17), and Rodway has listed a number of Tasmanian species. In "Records of Australian Fungi" (6), Cleland and Cheel discuss the occurrence and characters of several species recorded by Cooke. In 1931, Cleland (4) described eight new species, and, in a more recent publication (5) records sixteen species.

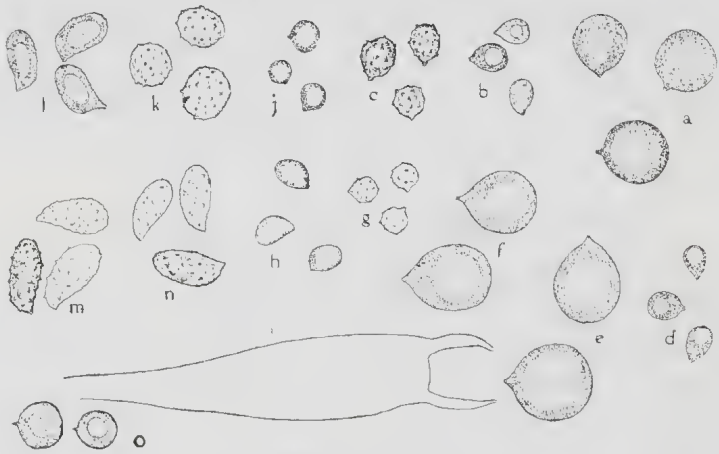
In 1932 McLennan (18) published an account of the common Victorian species of *Clavaria* to stimulate interest in them. Japanese work undertaken by Imai has some bearing on Australian studies in the group, as many species are common to both countries (11-14).

Genus *Clavaria* Vaill.

The most complete definition of the genus is that given by Coker (7). He says that the habit is "saprophytic, or in a few species saprophytically associated with algae." Since this description was published, one species, *C. Tochiniana* Imai (11), has been described as a parasite of cabbage. Since the first description of the genus there have been many attempts to subdivide it. (For full discussion see Coker(7)). The classification devised by Fries, which has been in common use for many

years, has been amplified by Coker so that the genus is divided into eleven groups, which he considers are "of a validity at least equal to accepted genera of agarics and other families of fungi," but he states that "to distinguish sharply between such groups is, however, no easier than in most cases of splitting, and we are inclined to choose here a course that we should like to see much more generally followed, which is to let the old genera alone until it becomes a greater inconvenience to retain them than to separate them."

In this paper Coker's classification has been followed and groups 3, 4, 7, 8 and 9 of the genus are dealt with.



TEXT FIGURE 1.

Spores of the following species of *Clavaria*: (a) *C. muscoides*. (b) *C. subtilis*. (c) *C. Kunzei* (from specimen at National Herbarium, Melbourne, identified by Cooke). (d) *C. cinnamomea* (type). (e) *C. cristata*. (f) *C. vinaco-cervina* (part of co-type). (g) *C. Crocea*. (h) *C. umbinella* and (i) basidium of *C. vinaco-cervina* (part of co-type). Note the two large incurved sterigmata. Spores of: (j) *C. Bizzozzeriana*. (k) *C. pyxidata* var. *asperospora* (type). (l) *C. gracilis*. (m) *C. crispula*. (n) *C. stricta*. (o) *C. Nymaniana*. Magnification $\times 1125$.

GROUP 3.

CLAVARIA MUSCOIDES Fr. ex L. *Flora Suecica* (2nd ed.), p. 457, 1755.

Plate I., Figs. 1 and 2.

Clavaria fastigiata L. *Flora Suecica* (2nd ed.) p. 457, 1755.

Clavaria corniculata Schaeff. *Fung. Bavar.* pl. 173, 1763.

Clavaria pratensis Pers. *Comm.* p. 52 (183), 1797.

Clavaria furcata Pers. *Ibid.*, p. 52, 1797.

Clavaria vitellina Pk. *Rept. N.Y. St. Mus.*, 43: 24, (70), 1890 (not *C. similis* Boud. and Pat.).

Clavaria Peckii Sacc. *Syll. Fung.* 9-249, 1891 (not *C. Peckii* Sacc. and D. Sacc.).

Clavaria helvcola var. *dispar*. Pers. *Myc. Europ.* 1: 181, 1822.

Clavaria fellca Pk. *Rept. N.Y. St. Mus.*, 51: 292, 1898.

Clavaria muscoides var. *obtusata* Britz. *Hymen. Sudb.*, *Clavariei*, fig. 45, 1879-97.

Clavaria straminea Cotton. *Trans. Brit. Myc. Soc.* 3, 265, pl. 11, fig. D, 1909-10.

Plants of moderate size, 5-8 cm. high, rarely simple, most often antlered or branched two or three or four times, growing in clusters of two or three separate plants, occasionally forming a large mass in which the individual plants are fused at the base, more or less rooting. Stem long or short, of the same diameter as the branches which are usually between 2 and 3 mm. in diameter, branching irregularly dichotomous, axils open and rounded, much flattened below, branches elongated, cylindrical, smooth and flexuous, tapering bluntly to form entire tips. Colour of young plants Light Orange Yellow, of mature plants Cinnamon Buff at the tips, shading to Clay Colour at the base.

Texture when young, moderately brittle, in age, rather tough. Flesh rather translucent but the outside layers i.e. the hymenial and sub-hymenial layers, are very opaque. Taste and smell slight, but acrid and unpleasant; in age, a strong odour of ammonia develops.

Spores white in mass, smooth, globose, with an abrupt minute apiculus 5.6-8 μ . Basidia 4-spored, sterigmata curved, about 7-8 μ long.

Coker describes the colour of *C. muscoides* as "varying from rather pale dull yellow to deep clear yellow or ochraceous yellow shading downward to darker brown." Mature plants found in Victoria are much browner than this. But Coker regards *C. straminea* Cotton as a synonym of *C. muscoides*. He states "no differences of any importance between *C. straminea* and *C. muscoides* appear from Cotton's description of the former. Simple plants of *C. muscoides* are not at all rare in Victoria, and could hardly be better described than by Cotton's diagnosis for *C. straminea*." The Australian plants are straw-coloured like *C. straminea*. Very yellow specimens have not been collected here.

Cooke records *C. muscoides* for Victoria and New South Wales, spores 6 μ diam. in pastures.

GROUP 4.

CLAVARIA CRISTATA Fr. ex Holmsk. Rolland, Champ. T 103, no. 230.

Plate 1, Figs. 3-5; Plate 2, Fig. 1; Text fig. 1, e.f.i.

Clavaria coralloides L. (in part) Fl. Suecica, 2nd ed., p. 457, 1755.

Clavaria albida Schaeff. Fung. Bavar. p. 116, pl. 170, 1763.

Clavaria laciniata Schaeff. *Ibid.*, p. 122, pl. 291, 1770.

Clavaria cinerea Bull. Herb. Fr. p. 204, pl. 354, 1787.

Clavaria rugosa Bull. *Ibid.*, p. 206, pl. 448, fig. 2, 1789 (not *C. rugosa* sensu Sowerby Engl. Fung. pl. 235).

Clavaria elegans Bolton. Hist. Fungi Halifax, p. 115, pl. 115, 1789.

Clavaria amethystea Bull. Herb. Fr. p. 200, pl. 496, fig. 2, 1790.

Clavaria cristata Holmsk. Beata ruris I: 92, pl. 23, 1790 (p. 97, Pers. ed. 1797).

Clavaria fimbriata Pers. N. Mag. Bot (Romer's) p. 117, 1794.

Clavaria trichopus Pers. Comm. p. 50 (182) pl. 4, fig. 3, 1797.

- Clavaria palmata* Pers. *Ibid.*, p. 45 (177) 1797.
Clavaria fallax Pers. *Ibid.*, p. 48 (180) 1797 (not *C. palmata* Scop.).
Clavaria grisca Pers. *Comm.* p. 44 (176) 1797.
Clavaria grossa Pers. *Ibid.*, p. 50 (182) 1797.
Clavaria macropus Pers. (sense of Fries and Bresadola) *Comm.* p. 51 (183) pl. 1, fig. 2, 1797.
Clavaria fuliginosa Pers. *Myc. Europ.* 1, 166, 1822.
Clavaria alba Pers. *Ibid.*, 1, 161, 1822.
Clavaria cristata var. *curta* Junghuhn. *Linnaea* 5, 407, pl. 7, fig. 2b, 1830.
Clavaria afflata Jagg. (sense of Bresadola) *Flora* 19 (1), 231, 1836.
Clavaria cristata var. *flexuosa* Junghuhn. *Linnaea* 5, 407, pl. 7, fig. 2a, 1830.
Clavaria Krombholzii Fr. *Épicer*, p. 572, 1838.
Clavaria lilacina Fr. *Hym. Eur.* p. 667, 1874 (not *C. lilacina* Junghuhn).
Clavaria dichotoma Godey. in Gillet. *Hym. Fr.* p. 766, 1874.
Clavaria Schaefferi Sacc. *Syll. Fung.* 6, 693, 1888.
Clavaria sphaerospora E. & E. *Journ. Mycol.* 4, 62, 1888.
Clavaria sublilacina Karst. *Finlands Basidsvampar* p. 375, 1889.
Clavaria Favreae (Quel) Sacc. & Trav. *Syll. Fung.* 19, 231, 1910.
Clavaria Herveyi Pk. *Rept. N.Y. St. Mus.* 45, 84, 1892 (*rugosa* form).
Clavaria cinerea var. *gracilis* Rea. *Trans. Brit. Myc. Soc.* 6, 62, 1917.
Clavaria mutans Burt., *Ann. Mo. Bot. Gard.*, 9, 31, pl. 6, fig. 41, 1922.
Clavaria histrix E. & E. *Herbarium* name.
Clavaria vinaceo-cervina Clel. *Trans. Roy. Soc. S.A.*, 1931.
Clavaria sub-rugosa Clel. *Ibid.*, p. 152-160.

Coker's description of *C. cristata* is as follows: "Remarkably variable in both form and colour. The typical form is whitish or pallid. Slender, narrow about 2-3 mm. thick below and 3-6 cm. high, long stalked with a few or several branches which are rather abruptly crested at the ends with small, pointed, more or less crowded branchlets; sometimes there is a single slender stalk with a dense crest at the tip, or there may be several stalks attached near the base and these may branch near the middle. Other forms besides the typical are included in the following notes. At times none of the branches is crested or some may be crested and others not; also the stem may be much flattened and expanded upwards, with a few irregular flat branches, or with no branches but rugose-wrinkled or knobbed. The tip is sometimes flattened and expanded like an antler, and in less complex forms the plants are apt to be somewhat enlarged and flattened upwards. Colour white at base and usually light-grayish flesh colour elsewhere, except the tips which are creamy white when young, then becoming coloured more like the branches and easily blackening after maturity. The colour varies from dull or creamy white to lavender gray (or with a tint of this colour with

tan), or smoky lavender pale to deep mouse gray, ash colour, drab or dull yellow, with all admixtures of these colours, surface even below, more or less channelled or wrinkled upwards. Flesh dry, toughish, not brittle, bending on itself without a complete break, creamy white, softer inside, and usually with one or two small uneven cavities in centre from separation of the fibres. odour almost none, taste mild, not very pleasant, bitterish, musty, at times a little like that of *Agaricus campestris*.

Spores when fresh, pure white, smooth, regular, sub-spherical to short elliptic, $5.2-7.4 \times 7-9.2\mu$, after standing for some time they become yellowish and often irregular by collapsing. Basidia 2-spored in all forms, the long stout sterigmata usually curved inward. Hymenium thick $110-165\mu$ and with many spores irregularly embedded through most of its area, indicating a great increase in thickness by irregular proliferation."

"Edible and of the best quality." (McIlvaine).

"The great variability of this plant has led to many names and much confusion. The large smooth sub-spherical spores, pliable texture and blackening tips are the surest guides." (Coker.)

Cotton and Wakefield only recognized *C. cristata*, *C. cinerea*, and *C. rugosa*, and say that it is possible that *C. cristata* may be a form of *C. rugosa*. Rea recognizes the following species and varieties:—

- Clavaria coralloides* (Linn.) Fr. (?)
- Clavaria cristata* (Holmsk) Fr.
- Clavaria cinerea* (Bull.) Fr.
- Clavaria cinerea* var. *gracilis* Rea.
- Clavaria rugosa* (Bull.) Fr.
- Clavaria rugosa* var. *fuliginosa* (Pers.) Fr.
- Clavaria rugosa* var. *macrospora* Britz.
- Clavaria grossa* Pers. Quel. (?=*C. Krombholzii*).
- Clavaria crassa* Britzl. (?=*C. rugosa*).
- Clavaria Krombholzii* Fr.
- Clavaria grisea* (Pers.) Fr.

Coker has collected a great number of spore measurements and other details, and concludes that all the forms listed as synonyms can be included in the species *C. cristata*.

Coker states: "We have been unable to find any differences either in gross character or in microscopic detail, of sufficient importance to enable us to distinguish species within the group." Romell stated that he could see no distinct limit between *C. cristata*, *C. cinerea*, and *C. rugosa*.

The commonest variety in Victoria appears to be the *cinerea* form, which is often found much incrassated and proliferated. I have not seen any large, much branched *cristata* forms, but small specimens up to $1\frac{1}{2}$ inches in height are common for the greater part of the year.

Cleland (4) has described a South Australian plant as *C. sub-rugosa*. It is "white, becoming slightly dingy. Pallid Greyish White or near Cartridge Buff. Spores spherical 5.6-7.5 μ ."

The spores of the South Australian plant are smaller than those given by Cotton and Wakefield for *C. rugosa*, and discussing Coker's work Cleland says: "We have cristate plants which we assign to *C. cristata* and it seems advisable to apply a definite name to these more simple, non-cristate specimens, whose spores do not agree in size with *C. rugosa* of the English workers."

Coker's spore measurements for the *rugosa-Krombholzii* forms are 7-9.3 x 8-11 μ , which is larger than in the South Australian form. But under the heading *cristata-cinerea* forms Coker gives spore measurements 5.5-8 x 6.7-10.5 μ , so that it is not impossible to include *C. sub-rugosa* as a synonym of *C. cristata*.

Cooke records *Clavaria cinerea*, Victoria; *C. cristata*, Victoria, Queensland, Tasmania; *C. rugosa*, Queensland; *C. Krombholzii*, Victoria. Cotton and Wakefield regard *C. Krombholzii* as synonymous with *C. Kunzei* which they say has spores minutely apiculate, 3.5-4.5 μ in diameter. Coker examined a plant identified as *C. Krombholzii* in Fries' collection. The spores are similar to those of *C. cristata*.

GROUP 7.

CLAVARIA NYMANIANA P. Henn. Monsumia, 1, 1899, p. 9.

(Plate IV., Fig. 2.)

Plants branched irregularly or dichotomously, usually arising several together with the stems closely adpressed, but slender and distinct, up to 10cm. high, usually 5 cm. Branches closely adpressed one to another, axils rounded. Entire plant Slate Violet when fresh, fading to Wood Brown in age. Base of plant distinctly woolly and of the same colour as the plant.

Flesh rather brittle, concolorous with the surface when moist; if the plant is drying, white and cottony; becoming rather pliable towards the base, which is rather elastic and distinctly tough. (When the plant is deeply rooting or small this character is not so marked.) Taste and odour mild.

Spores not copious, white, with a bluish tinge in mass. Microscopically hyaline, smooth, sub-globose, 3-5.5 μ with one guttule. Habitat—on ground. Localities: Apollo Bay, Mount Evelyn.

C. amethystina Fr. ex Batt., as interpreted by Coker, shows certain similarities with this plant, viz., colour, tender and pellicid flesh and dichotomous branching. Coker's illustrations (pl. 24 and 25) suggest that his plant has the same habit as ours, but the

points in his description which do not agree are, (a) spores with one end pointed, (b) colour darker uppermost, tinted with buff at the base. In our plant the colour tends to persist at the base when it has faded from the upper parts, (c) base apparently smooth. In the Victorian plant the woolliness and toughness of the base is very marked.

Rea's description of *C. amethystina* gives the trunk as concolorous or whitish and the flesh tinged violet, becoming whitish, spores white, elliptical, obtuse at both ends $6-7 \times 3-4\mu$. Cotton and Wakefield say that the smell is strong and the taste tallowy, stem scarcely distinct. Branching irregular, axils not flattened, branches often attenuated. Spores smooth, hyaline, globose, with a minute basal apiculus $5-7\mu$ diameter, turning rapidly to yellowish on drying.

The spores of *C. amethystina* described above are much larger than in the Victorian plant, and in addition the colour and habit are not the same.

C. Nymaniana is closely related to the Victorian plant, and Henning's description fits the Victorian plant fairly well. The only difference lies in the fact that the stem of the true *C. Nymaniana* is smooth, but Henning also states that it is flexible. It has not been possible to obtain a type specimen of *C. Nymaniana*, but in view of the fact that its description agrees closely with that of our plant it is advisable to regard the two as belonging to the same species.

GROUP 8.

CLAVARIA SUBTILIS: Fr. ex. Pers. Pers. Comm. T.4, fig. 2.

(Plate III., Fig. 2, Text Fig. 1b.)

Plants white, cream in age, slender, 2-4 cm. high growing separately or in tufts, usually with a distinct slender cylindrical stem equal to $\frac{1}{4}$ or $\frac{1}{2}$ the plant in height, from the top of which the few branches arise or branching at the base giving the appearance of two fascicled individuals: the branches are often bent so as to resemble prongs. Stem and branches smooth, glabrous, equal, axils patent. Tips often long, gently tapering to a blunt point. Flesh white, delicate, but rather tough. Internal structure of interwoven hyphae $4.5-8\mu$ thick. Taste and odour none. Hymenium 30μ thick. Basidia with two or four sterigmata. Spores, white in mass, microscopically hyaline, smooth, oval, or rectangular-elliptical, with an oblique apiculus, once guttulate $3.5-4.3 \times 2.2-3.6\mu$. Habitat—on damp soil in gullies, widespread in Victoria.

Coker describes *C. Kunzei* as a rough spored form, but he considers *C. subtilis* Fr. ex. Pers. to be a synonym. His illustration of *C. Kunzei* (pl. 29, Coker) suggests a different plant from the

one Bresadola gives, and also from the Victorian plants. But Coker has examined a plant labelled *C. subtilis* in the Bresadola Collection at the New York Botanical Garden, and says it is exactly like *C. Kunzei* in form and spores. Bresadola's description of *C. subtilis* is "Gracilis, sub-tenax, ramosa, ex albida pallide straminea, 3-4 cm. alta, basi subglabra. Trunco e ramis subaequalis vix 2 mm. crassis. Rami pauci dichotomi, subfastigati, apice attenuate, sporae ellipsoideae-ovoideae, basi distincte apiculatae, hyalinae, leves 3-5 x 2.5-4 μ . Bas. clav. 25-30 x 5-8 μ ." Bresadola's illustration of the plant and its spores suggest that the plant he called *C. subtilis* is the same as our plant. The only difference lies in the fact that he shows spores with two guttules, while those of our plant have one.

Rea considers *C. subtilis* and *C. Kunzei* as separate species, but in neither case does he mention any spore markings. His description of *C. subtilis* fits our plant, except that the spores are larger in his form.

Coker's illustration of *C. Kunzei* suggests a different plant from the one under consideration, and the National Herbarium (Melbourne) specimen of *C. Kunzei* is quite different from it, as it shows an antlered type of branching and has rough spores, which do not resemble those of any plant of this group collected in Victoria.

It is therefore evident that the two plants *C. subtilis* and *C. Kunzei* are distinct species and may be identified briefly as follows:—*C. Kunzei* white, small, showing antlered type of branching, spores rough; *C. subtilis*, white, small, branches dichotomous, cylindrical, spores smooth.

CLAVARIA KUNZEI Fr. Syst. Myc. 1, 474, 1821.

(Text Fig. 1c.)

Cooke (8) records this plant from Queensland and a specimen identified by him is in the National Herbarium, Melbourne. He describes it: "Rather fragile, white, very much branched from a thin base (2-6 cm. high), branches elongated, crowded, repeatedly furcate, fastigiate, even, equal, compressed at the axils. Spores sub-globose 9-12 x 8 μ , hyaline. In Woods, Queensland."

There is no doubt that this specimen is correctly identified, as it fits Coker's description, but the spore measurements Cooke gives (sub-globose 9-12 x 8 μ hyaline) are incorrect. The specimen has sub-globose, hyaline spores 2.5-3.5 x 3.5-4.5 μ , which are very rough for their size. It is in a fragmentary condition and is brown in colour, but it shows the typical antlered branching and some scurfy-velvety areas, particularly at the top of the stem.

As the plant has not been collected in Victoria there has been no opportunity to make a description from a fresh specimen. Coker (7) gives an excellent description of the species.

CLAVARIA CINNAMOMEA n. sp.

(Plate III, Fig. 3.)

Plantae parvae gregariae vel solitariae, rarius simplices, saepius ramosae. Stirpes gracilis teres circa 1 mm. lata, non radicans. Rami pauci dichotome summo ex stirpe nascentes. Ramis patentibus axiles partes inferiores ramarum saepe latae. Rami 1-2.5 mm. lati angustiores, teretes, latiores compressi, sulcus utrimque late apertus. Apices obtusi, raro acuti, in plantis juvenilibus obtuse dentate. Color stirpis "Mikado Brown" ad "Soyal Brozen," rami superiores et apices "Cinnamon Buff" ad "Pinkish Buff." Sporae leves albae hyalinae gutta unica in distali spori extremo sita, ellipsoideae, extremo apiculo obliquo 2.8-4.2 x 1.9-2.9 μ av. 3.45 x 2.42 μ . Basidia quattior sterigmati. Hab. ad terram in silvis. Loc. Cockatoo.

Plants gregarious or solitary, small 1.5-4 cm. high, rarely simple, most often branched. Stem slender, cylindrical, about 1 mm. broad, occasionally slightly bent, not rooting. Branches few, arising dichotomously from the top of the stem. Branching open, axils and lower parts of the branches often flattened, branches 1-2.5 mm. broad, the narrower ones cylindrical and smooth, the broader ones often flattened, with a broad, open furrow on either side. Tips blunt, very occasionally pointed, in young plants bluntly toothed. Colour of stem Mikado Brown to Soyal Brown, of upper branches and tips Cinnamon Buff to Pinkish Buff. Spores smooth, white in mass, elliptical, microscopically hyaline, with one guttule situated in the distal end of the spore, with a prominent terminal apiculus 2.8-4.2 x 1.9-2.9 μ , av. 3.45 x 2.42 μ . Basidia with four sterigmata. Habitat: on ground in fern gullies. Locality: Cockatoo.

The plant is easily recognized in the field by its characteristic form which resembles that of *C. crocea*, and by its colour, which is always darker at the base. It is distinguished from *C. umbrinella* Sacc. by its smaller spores and rather fleshy texture. In addition the colour of *C. umbrinella* is uniform.

CLAVARIA UMBRINELLA Sacc. Syll. 6, 695, 1888.

Clavaria umbrina Berk. Outlines of Brit. Fung. Pl. 18, Fig. 3-4, 1860.*Clavaria subumbrinella* Imai. Trans. Sapporo Nat. Hist. Soc., xiii, Pt. 4, p. 386, 1934.

(Fig. h.)

Plants moderately small and simple, up to 5 cm. high, branching dichotomously three or four times from a slender stem which may be fused with others at ground level. The stem may be equal to as much as half or two-thirds the plant in height. Branches cylindrical, about 1.5 mm. diameter; axils rounded, not flattened. General trend of the branches upright. Tips relatively long, and tapering to a blunt point. Colour, Pinkish Buff to

Cinnamon Buff, but with slightly less pink than these shades. Base slightly tomentose, two-thirds of the plant upwards faintly white pruinose. Flesh whitish, firm, opaque, rather fibrous, smell and taste none. Spores, white in mass, microscopically hyaline, sub-globose, smooth, with a minute apiculus $2.2-3.2\mu \times 3.3-4.2\mu$. Habitat—on damp ground under scrub. Locality, Mt. Evelyn. Not previously recorded for Australia.

In general appearance the plant resembles *C. Bizzozzeriana*, but may be distinguished by its colour and firm texture.

It is to be noted that in Rea's description of *C. umbrinella* the spores are slightly larger than in the Victorian plant, and also that the branches are distinct to the base. Our plant could be so described, or could be interpreted as a cluster of several plants fused at the base.

Imai (14) describes a species *C. subumbrinella* "solitaria, ter quaterve ramosa, umbrina (tawny olive) circa 5 cm. alta, ramis dichotomis, apicibus subacutis, stipite distincto, parte subterranea teniter albo-tomentosa, basidiis clavatis, sporis in cumulo albis crasso ellipsoideis, levibus circa 5×3 . Hab. ad terram in silvis.

The fungus somewhat resembles *C. umbrinella* Sacc. and is distinguished by the slightly tomentose stipe and by the method of branching. *C. umbrinella* has no stipe and branches at the basal part of the plant".

The only real points of difference between this species and *C. umbrinella* are, (a) the slight tomentosity of the base of the stem which is lacking in *C. umbrinella* (but the Victorian plant which fits the description of *C. umbrinella* shows this character), (b) the type of branching. The Victorian plants of *C. umbrinella* are all branched right to the base, but *C. Bizzozzeriana*, which is obviously closely related, is found growing singly or fasciated in small groups of two or three, which could be regarded as one plant branching from the base (see plate). In this case there is no suggestion that the single plants and those growing in groups are of different species. Accordingly, as the descriptions of *C. umbrinella* and *C. subumbrinella* differ only in minor characters which are intermediate in the Victorian representative of the species, it is reasonable to regard them as synonymous.

CLAVARIA BIZZOZGERIANA Sacc. Syll. 6, 693, 1888.

(Plate III., Text Fig. 1j.)

Clavaria tenuissima Sacc. Michelia 1, 436, 478 (not *C. tenuissima* Lev. Ann. Sci. Nat., 3rd ser., 5, 156, 1847).

Clavaria conchylata Allen. Trans. Brit. Myc. Soc., 3, 92, 1908.

Plants branched, small and delicate 1-3.5 cm. high, solitary or a few together, growing on bare ground or amongst moss.

Stem slender, usually half the plant in height, often white pruinose below. Branching dichotomous and open, the branches cylindrical, comparatively long and slender and curved inwards slightly so that they resemble prongs. Axils rounded, not flattened, tips sub-acute, tapering gently to a blunt point. Young plants simple and club-like, about 1 cm. high and with a few small teeth at the apex. When young the entire plant is Slate Violet or Ramier Blue, in age the base becomes Avellaneous and the branches Greyish Lavender. Flesh solid, concolorous, fading with the surface, pliable, and except at the ultimate branches, which are very brittle and fragile, not snapping with a clean break when bent. Flesh of stem becoming fibrous in age. Spores smooth, hyaline, globose, 2.5-3.5 μ diameter, minutely apiculate, white in mass, microscopically hyaline.

Our plants fit the description of *C. Bizzozzeriana* as given by Cotton and Wakefield. But Coker considers *C. Bizzozzeriana* a synonym of *C. pulchella* Boud. Boudier describes *C. pulchella* as having flattened branches and denticulate tips. The spores of his plant are 4-5 μ long, oval. Also the stem and lower parts of the branches are white, only the upper parts of the plant being violet. Boudier's illustrations are reproduced in plate 3, fig. 4, and from these it can be seen that our plants do not resemble *C. pulchella* in form, having rounded branches, entire tips and globose spores, and an almost uniform violet colour. Coker has not seen *C. Bizzozzeriana* in the living state but regards *C. exigua* Pk. as the same. The description he gives of *C. pulchella* (= *C. Bizzozzeriana*) is adapted from Peck's account of *C. exigua*. From this description it may be seen that *C. exigua* and *C. pulchella* have a similar habit and colour distribution, and the spores are alike, so it is possible that they are synonymous. *C. Bizzozzeriana* differs from them both in not having a white base, and in spore size. These differences are sufficient to justify keeping *C. Bizzozzeriana* as a separate species.

In 1878 Saccardo first named the plant known as *C. Bizzozzeriana*, *C. tenuissima*, but, as Leveille had, in 1847, already given another plant this name, Saccardo changed the name to *C. Bizzozzeriana* in 1888. *C. conchylata* Allen is regarded as synonymous with *C. Bizzozzeriana* by Rea, and Cotton and Wakefield, and the descriptions agree well.

It is interesting to note that *C. arborescens* which Berkeley described from New Zealand (Hooker, Fl. N.Z., 11, p. 186, London, 1855) may be the same as *C. Bizzozzeriana*.

The description is "sparsa, amethystina, gracilis, stipite tenui elongato, simplici, ramis furcatis fastigiatis, ultimis brevissimis, acutis". In the absence of details of spore characters it is impossible to be certain of the identity of the plant.

CLAVARIA CROCEA Fr. ex. Pers.

Pers. Comm. p. 57 (189), 1798.

(Plate IV., Fig. 3, Text Fig. 1g.)

Plants small, growing in groups, but not fasciated, 1-5 cm. high, branching from a slender stem, which is long or sometimes quite short, occasionally slightly tomentose, equal to about half the plant in height, in age a darker colour than the branches. Branches arising dichotomously from the top of the stem, three or four times furcate; axils rounded, often flattened, in which case the branches have an antlered appearance and show several broad, shallow longitudinal furrows. Branches often smooth and sub-cylindrical: tips blunt. Colour, Orange, Capucine Yellow, Orange Buff, the base of the plant darker than the tips. In age fading to Light Orange Yellow with somewhat yellower tips.

Flesh concolorous, soft and brittle, more flexible when old. Smell none, taste mild, occasionally bitter. Basidia with four sterigmata, spores distinctly rough, white in mass, microscopically hyaline, sub-globose once guttulate. In sheltered places, or among grass and moss in more open situations.

Cooke records this species for Victoria but gives an inaccurate spore measurement ("spores ellipsoid, 6-7 x 2-3 μ "). Cleland has recognized it in South Australia and gives an illustration of typical plants, which are much smaller than the Victorian ones. Coker says *C. crocea* is one of the rarest Clavarias and is unsurpassed for delicacy and beauty. Although he says the plant has been collected only a few times since Persoon's day, it is not uncommon in Victoria and reaches a large size.

Cotton and Wakefield exclude *C. crocea* as being indeterminate. The specimens on which Berkeley based the English record are at Kew but show no spores.

CLAVARIA PYXIDATA Fr. ex. Pers. var. *asperospora* n. var.

Pers. Comm. p. 47, (179), 1797.

Fr. Hym. Eur., 669, 1871.

(Plate IV., Figs. 1, 4, 5, Text Fig. 1k.)

Plants up to 10 cm. high, often extremely small, springing in clumps or singly from decaying wood. Main stem slender, sometimes somewhat pubescent, sometimes with brown hispid fibres at the base. "Stems round, often channelled, becoming thicker upwards dividing simultaneously like an umbel into several branches, which spread out rather strongly and then turn up again, primary branches expanding suddenly at their tips into little cups, from the margins of which spring the branchlets of

the third degree. These may again end in cups with similar branches which finally terminate in smaller cups with little teeth on the rims". (Coker, p. 94). Colour, Wood Brown to Avellaneous, base Cinnamon Brown. Flesh quite pliable and not at all brittle except at the tips, tough, especially at the base. Very peppery to the taste. Spores pure white in mass, definitely roughened, sub-globose $3.2-4 \times 4-4.8\mu$. Basidia 4-spored, $3.5-4.6\mu$ thick, inconspicuous, hymenium about 30μ thick with many projecting cystidia of two kinds, either fusiform, pointed, hyaline, and with scanty cell contents, or cylindrical with rounded tips, somewhat resembling the gloeocystidia of *Physalacria*. Hyphae just beneath the hymenium, fine, 3.5μ thick, varying to 11μ in the centre, clamp connections present. Always found growing on decaying wood (in Australia chiefly on Eucalypts, rarely on Acacias, etc.).

This species is very widely distributed in Victoria and in most temperate parts of the world. It is easily recognized in the field by the cup-shaped expansions at the ends of the branches, the brownish colour, and the peppery taste.

The form of *C. pyxidata* which occurs here shows certain differences from the type viz.: brown hispid fibres are often absent from the base, brownish colour even when young, and, chiefly, in having spores which are distinctly rough. The European and American plants are "rather light clear yellow" when fresh, have hispid fibres at the base and, in addition, smooth spores. Accordingly, although the two forms have exactly the same type of branching and both possess cystidia of two kinds, it was decided to describe the Australian plants as a new variety.

CLAVARIA PYXIDATA var. *asperospora* n. var.

Forma habitusque similis Clavariae pyxidatae Fr. ex. Linn. Color "Wood Brown" ad "Avellaneous". Basis "Cinnamon Brown" pubescens saepe sine fibris hispidis, sporae hyalinae, sub-globosae, perspicue asperae $3.2-4 \times 4-4.8\mu$. Loc. Sherbrooke, Victoria.

"Branching and habit like *C. pyxidata* Fr. ex. L. Colour Wood Brown to Avellaneous. Base Cinnamon Brown, pubescent, often without hispid fibres. Spores hyaline, sub-globose $3.2-4 \times 4-4.8\mu$ distinctly rough. Sherbrooke, Victoria".

I have examined plants from Victoria and Tasmania and find the characters mentioned constant. Cleland does not record the species for South Australia, Cooke records it for New South Wales and Victoria. Cotton and Wakefield do not recognize *C. pyxidata*, regarding it as possibly an abnormal form of *C. stricta*. It seems that they have not examined it in the fresh state, as it is one of the most easily recognized species. Its

peculiar type of branching is unmistakable; also its spores admit of no confusion with those of *C. stricta* as they are white and sub-globose; *C. stricta* has ochraceous, pip-shaped or elliptical spores 6-9 x 4-5 μ .

GROUP 9.

CLAVARIA CRISPULA Fr. Syst. Myc., 1, 470, 1832.

(Plate V., Fig. 2, Text Fig. 1m.)

Plants branched, up to 5 cm. high, growing in colonies among pure wood debris around or under trunks. Subiculum very extensive, white, ropy or effused, stems arising from this, about 2-3 mm. diameter, rather woolly at the base, and with several rhizomorphs attached. Stems branching a short distance above the base into two or three main branches, which divide irregularly or dichotomously once or twice to form a large number of fine ultimate branchlets, which are often less than 0.5 mm. broad, (usually 0.5-1 mm.). Branches rounded, rather flexuous, but generally tending in an upright direction. Tips subulate and divaricating.

Colour, creamy when fresh, Ochraceous when old, the tips usually lighter than the body of the plant; entire plant on drying Isabella Color. Flesh concolorous, creamy, not changing colour on bruising, soft and dry, not breaking when bent upon itself, pliable and resilient. On drying the branches become hair-like and very fragile.

Spores ochraceous, copious, slightly colored when examined microscopically, elliptical to pip-shaped, with an oblique terminal apiculus, 6-6.9 x 3.2-4.1 μ distinctly roughened, almost spiny. Hymenium smooth, basidia with four sterigmata. Locality, Cockatoo. May. Not previously recorded for Victoria. Recorded by Cooke (8) for Western Australia.

The soft toughish texture of this plant distinguishes it from any other *Clavaria* occurring in Victoria. Rea (16) gives Masee's description of *C. crispula*. This fits our plant, except that the spores are said to be 5 x 3 μ . These are slightly smaller than those of the Victorian plant, but Masee makes no reference to their roughness. Cooke also gives Masee's description. Coker (7) lists *C. crispula* as a doubtful synonym of *C. decurrens* Fr. ex. Pers., but comparing our plant with Coker's description of *C. decurrens* it is evident that they are not the same. The flesh of *C. decurrens* stains pink when bruised, the branches are angular and flattened, and the spores are smaller than in our form, which has rounded branches, the flesh not staining pink when bruised. Another point is that in our plant the hymenium is single. In *C. decurrens* it proliferates. The Victorian plant

is distinct from any other I have collected, and, as it fits the description of *C. crispula* as understood by Massee and Rea, I would prefer to regard it as distinct from *C. decurrens*, as described by Coker and to place it in the species *C. crispula*.

CLAVARIA GRACILIS Fr. ex. Pers. Comm. p. 50 (182) 1797.

(Plate V., Figs. 1 and 3, Text Fig. 11.)

Clavaria alutacea Lasch. in Rabenhorst Klotzschii Herbarium Vivum, Mycologicum Cent. 16, No. 1519, 1851.

Clavaria fragrans E. & E., N. Am. Fungi, 2nd ser., No. 2033, 1888.

Clavaria fragrantissima Atk., Ann. Myc., 6, 57, 1908.

Clavaria flavuloides Burt., Ann. Mo. Bot. Gard., 9, 28, pl. 5, fig. 34, 1922.

Plants 3–9 cm. high, 1–6 cm. broad, gregarious, often crowded in extensive clumps, sometimes growing in rings. Plants slender and delicate, varying to large and rather firm, mycelium forming a distinct layer beneath the surface of the mass of pine needles and binding the needles and other debris together. Trunks 3–7 mm. diameter, 1–3 cm. in length, arising directly from the mycelium, with a few large rhizomorphic strands attached; branching dichotomously six or seven times in an upright fashion, the ultimate branches ending in short, acute irregular processes which often divaricate. Branches usually flattened at the axils, which tend to be lunate in the lower parts of the plant, but somewhat compressed in the upper parts. Colour, body of the plant Warm Buff or Light Ochraceous Buff or paler; tips, Ochraceous Salmon or Whitish. Flesh paler than the surface, not changing colour when cut or bruised, soft and delicate, but not brittle. Odour distinct, faintly medicinal, disappears on drying, taste faint, but similar. Spores pale ochraceous, broadly elliptical with an obliquely terminal mucro, slightly rough, varying to almost smooth, 3.3–4.9 x 4.8–6.2 μ . Basidia 4.5–6 μ thick with four sterigmata, hymenium 40–50 μ thick. Threads of flesh and subiculum between 3 and 9 μ wide, showing clamp connections. Habitat, among fallen needles beneath *Pinus insignis*. Locality, Durdidwarrah, Brisbane Ranges. June. Not previously recorded for Victoria. Recorded by Cleland for South Australia. This plant is readily recognized in the field by its place of growth, slightly fragrant odour and by its colour.

Coker's illustrations and descriptions are in very close agreement with the plant as it occurs here. He states that Persoon's original description fits the American plants perfectly.

CLAVARIA STRICTA Fr. ex. Pers. Hym. Eur. 673.

(Plate V., Fig. 4, Text Fig. 1n.)

Lachnocladium Atkinsonii Bres. Journ. Myc. 8, 119, 1902.

Clavaria leucotephra B. & C. Grevillea 2, 7, 1873.

Clavaria condensata Fr. Epicr., p. 575, 1838. (Sense of Bresadola and Romell.)

Clavaria syringarum Pers. Myc. Europ. 1, 164, 1822.

Clavaria Kewensis Mass. Journ. Bot. (Britten's) 34, 153, 1896.

Lachnocladium odoratum Atk. Ann. Myc., 6, 58, 1908.

Clavaria Lorithamnus Berk. Aust. Fungi, No. 46, Journ. Linn. Soc. London, 1872.

Plants branched, up to 7 cm. high and 5 cm. broad, growing on decaying wood, or on soil with a large admixture of wood debris; stem arising from a more or less distinct hyphal layer and usually with several white rhizomorphic strands attached to it, slender, pubescent, dividing rather quickly and irregularly into many smaller branches which, after branching once more, divide to form the pointed apices. Axils very narrow, not flattened. Branches always very erect, top of the plant usually pointed. Colour of main part of the plant between Honey Yellow and Isabella colour, or Ochraceous Buff or Light Ochraceous Buff, tips creamy. Taste and smell like radish, and rather strong. Flesh soft and translucent but tending to be tough, when old very brittle and watery. On drying, the plant becomes hard and the surface appears woolly and the colour becomes uniformly Chamois or Honey colour. Spores ochraceous, 3.5-4.5 x 6.3-9 μ , elliptic with a large obliquely terminal mucro, distinctly rough, almost tuberculate in some collections. Basidia with four sterigmata 7-9.2 μ thick about 40 μ long. Localities: Healesville and Bayendeen. Not previously recorded for Victoria. In the field this species is chiefly distinguished by its compact appearance, erect branches, and strong smell and taste of radish.

The plant which I am calling *C. stricta* shows certain points of difference from the true *C. stricta*. It has no sterile areas of different appearance from the rest of the plant, showing a roughish, plush-like surface under a lens. These are said to be quite extensive in *C. stricta* as it occurs in other countries. The spores in the Victorian specimens are much rougher and slightly smaller than for well authenticated specimens of *C. stricta*. Of *C. stricta* it is said that many spores show the contents collapsed away on one side, near the mucro, giving the appearance of a very long and abrupt mucro. I have not observed this.

Cooke recorded *C. stricta* for New South Wales and Queensland and his description fits our plant very well.

Clavaria lorithamnus Berk. is described as "pallidumber, branches straight, apices shortly bifid and rather acute, 4 cm. high, spores hyaline. On the ground, Victoria. This is said to have exactly the form of *C. stricta*, but to have no rhizomorphs at the base."

Some of the specimens of *C. stricta* which have been sent to me have been reported as growing on the ground, but further

enquiries revealed that they were attached to buried wood or to be growing in soil rich in decaying wood, and in some cases rhizomorphs were absent.

I have not been able to obtain a specimen of *C. lorithamnus*, but in view of the occurrence of *C. stricta* without rhizomorphic strands there is no doubt that *C. lorithamnus* is merely an abnormal form of it.

References.

1. BOUDIER, M.—Champignons nouveaux, rares on peu connus de France. *Bull. Soc. Myc. Fr.*, 1887-1888, p. 146.
2. BRESADOLA, J.—Iconographica Mycologica.
3. BURT, E. A.—The North American Species of *Clavaria*, with illustrations of the Type Specimens. *Ann. Mo. Bot. Gard.*, ix., 1922, pp. 1-78.
4. CLELAND, J. B.—Australian Fungi: Notes and Descriptions, No. 8. *Trans. Roy. Soc. S.A.*, lv., 1931, pp. 152-160.
5. CLELAND, J. B.—Toadstools and Mushrooms and other Larger Fungi of South Australia. Pt. II. Adelaide, 1935.
6. CLELAND, J. B., and CHIEEL, E.—Australian Fungi: Notes and Descriptions, No. 4. *Trans. Roy. Soc. S.A.*, xlvi., 1923, pp. 60-78.
7. COKER, W. C.—The *Clavarias* of the United States and Canada. Chapel Hill, U.S.A., 1923.
8. COOKE, M. C.—Handbook of Australian Fungi, London. 1892.
9. COTTON, A. D., and WAKEFIELD, E. M.—A Revision of the British *Clavariac.* *Trans. Brit. Myc. Soc.*, vi., 1918, pp. 164-198.
10. ENGLER and PRANTL.—Die natürlichen Pflanzenfamilien. Leipzig. 1900.
11. IMAI, S.—On the *Clavariaceae* of Japan—I. *Trans. Sapporo Nat. Hist. Soc.*, xi., Pt. 1, 1929, pp. 38-44.
12. IMAI, S.—On the *Clavariaceae* of Japan—II. *Ibid.*, xi., Pt. 2, 1930, pp. 70-77.
13. IMAI, S.—On the *Clavariaceae* of Japan—III. *Ibid.*, xii., Pt. 1, 1931, pp. 9-22.
14. IMAI, S.—On the *Clavariaceae* of Japan IV. *Ibid.*, xiii., Pt. 4, 1934, pp. 58-78.
15. KALCHBRENNER, C.—Definitions of Some New Australian Fungi. *Proc. Linn. Soc. N.S.W.*, vii., p. 104-106. 1882.
16. LINDER, D. H.—The genus *Myxomycidium* *Mycologia*, xxvi., 1934, pp. 332-343.
17. MCALPINE, D., and RODWAY, L.—Australian Fungi. *Ay. Gaz. N.S.W.*, 1896, vii., 2, pp. 84-87.
18. MCLENNAN, E.—Notes on Australian Coral Fungi: *Clavaria* L. spp. *Vic. Nat.*, xlix., 1932, pp. 28-34.
19. REA, C.—British Basidiomycetae, Cambridge, 1922.
20. RIDGWAY, R.—Color Standards and Color Nomenclature. Washington. 1912.
21. SACCARDO, P. A.—Sylloge fungorum omnium cognitorum, 1882.
22. SMITH, W. G.—Synopsis of the British Basidiomycetes. London. 1908.
23. SOWERBY, J.—Coloured figures of English Fungi. 1797-1809.

Explanation of Plates.

All illustrations are natural size.

PLATE I.

- Fig. 1.—*Clavaria muscoides*. Simple plants.
 Fig. 2.—*C. muscoides*. Large complex plant.
 Fig. 3.—*C. cristata*. Small, sparingly branched, white form.
 Fig. 4.—*C. cristata*. Incrassated *cinerea* form.
 Fig. 5.—*C. cristata*. *Rugosa* form.

PLATE II.

- Fig. 1.—*Clavaria cristata*. Most of these plants show the wrinkling of the surface typical of the *cinerea* form, but there is also a tendency towards the production of cristate branches in the upper parts of the plants.

PLATE III.

- Fig. 1.—*Clavaria Bizozzeriana*. All types of plants between simple clubs and relatively large and complicated forms are shown. (The tips of some plants are shrunken through drying.)
 Fig. 2.—*C. subtilis*.
 Fig. 3.—*C. cinnamomea* (type).
 Fig. 4.—Boudier's illustrations of *C. pulchella*, *ii* shows entire plant with white base, *iii* the denticulate tips and *iii* the elongated spores.

PLATE IV.

- Fig. 1. *Clavaria pyxidata* var. *asperospora*, showing branches arising from cup-like expansions. Medium sized plants.
 Fig. 2.—*C. Nymaniana*.
 Fig. 3.—*C. crocea*.
 Fig. 4.—Minute plants of *C. pyxidata*.
 Fig. 5.—Large single plant of *C. pyxidata* var. *asperospora*. Notice that the branching is typical in the upper parts of the plant, but thickening of the branches at the base has obscured the cup-like expansions.

PLATE V.

- Fig. 1. *Clavaria gracilis*. Two clumps composed of small plants.
 Fig. 2. *C. crispula*.
 Fig. 3. Large plant of *C. gracilis*.
 Fig. 4.—*C. stricta*. Single plant, base missing.

